Gov.Doc.
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G
Canada. Geodetic Service

DEPARTMENT OF THE INTERIOR, CANADA

HON. THOMAS G. MURPHY, Minister R. A. GIBSON, Assistant Deputy Minister

GEODETIC SURVEY OF CANADA

NOEL J. OGILVIE, Director

ANNUAL REPORT

OF THE DIRECTOR

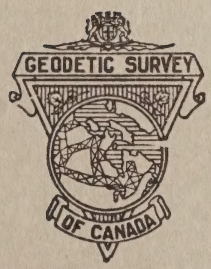
OF THE

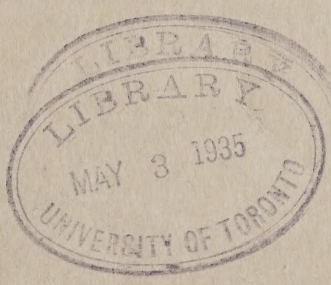
GEODETIC SURVEY OF CANADA

FOR THE

FISCAL YEAR ENDING MARCH 31, 1934

1933/34





OTTAWA
J. O. PATENAUDE
PRINTER TO THE KING'S MOST EXCELLENT MAJESTY
1935

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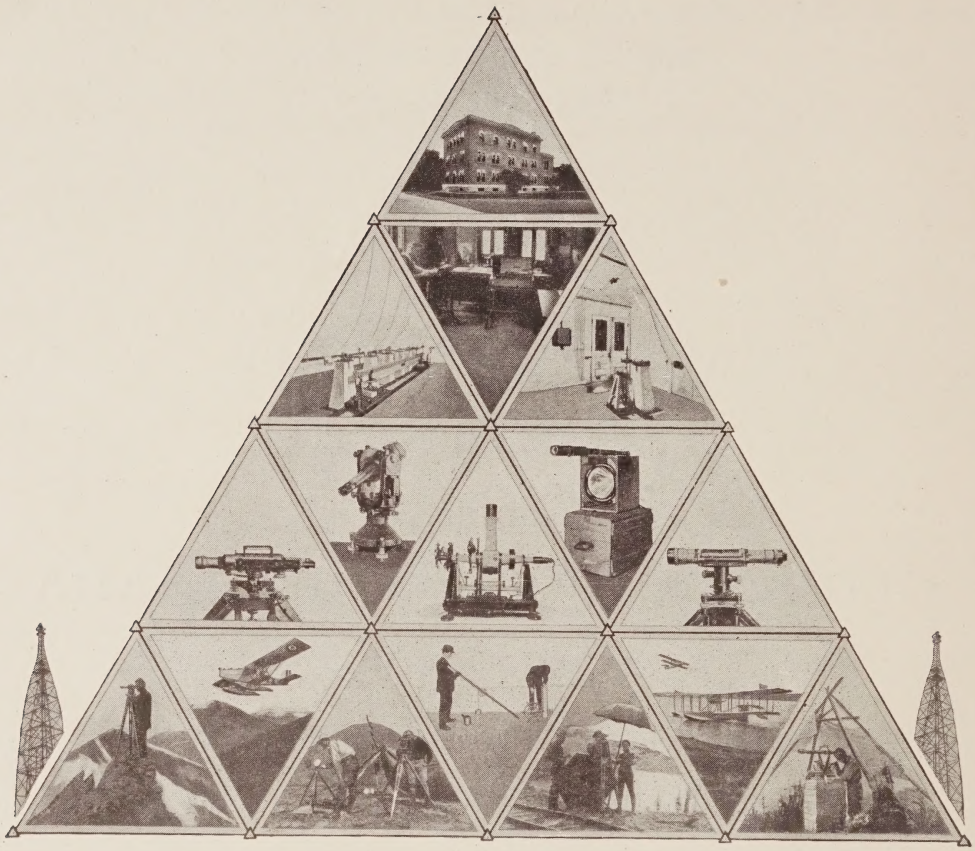


OPERATIONS OF THE GEODETIC SURVEY OF CANADA

Top—Geodetic Survey Building at Ottawa.

Second row, left to right—

North end of Standard building, showing five-metre apparatus.
Office of Precise Level Adjusting Division.
Fiducial point at south end of 50-metre comparator, in Standard building.

Third row, left to right—

Precise Level, U.S.C. & G.S. Pattern.
Latest Model Primary Triangulation Model theodolite.
Latest Model Astronomical Transit.
Electric Signal Lamp for Primary Triangulation.
Precise Level, Zeiss Model.

Bottom row, left to right—

Observing on Secondary Triangulation.
Photographic and Transport Hydroplane, Canadian model.
Sending instructions to light keepers by heliograph.
Setting rear end of tape in Base-line measurement.
Observing Precise Levels in the Yukon Territory.
A Transport Hydroplane at rest.
Observing Primary Triangulation.

On flanks—

Triangulation Tower near Chatham, Ont., with Lamp-stand extended 37 feet. Height of Lamp-stand: 147 feet.

THE GEODETIC SURVEY OF CANADA

ANNUAL REPORT OF THE DIRECTOR, NOEL J. OGILVIE

INTRODUCTION

The operations of the Geodetic Survey of Canada, Department of the Interior, comprise triangulation reconnaissance, primary triangulation, precise levelling, geodetic astronomy, triangulation base-line measurement, isostasy, geodetic research, triangulation adjustment, precise levelling adjustment and the publication of geodetic survey data.

Field parties carried on restricted operations in primary triangulation in the province of Ontario. The inspection of bench-marks was carried on in the province of Quebec.

Observations were made in connection with the International World-Longitude campaign instituted by the International Geodetic and Geophysical Union.

Progress was made in the adjustment of geodetic triangulation and the adjustment of precise levelling.

Further study of the problem of transferring triangulation results from the Clarke spheroid to the International ellipsoid now adopted by the International Geodetic and Geophysical Union has been made. Further study has also been made of the problem of the direct and inverse solutions of geodetic lines of major length.

A series of publications giving adjusted values for triangulation results extending from the Great Lakes to the Atlantic ocean has been completed and distributed.

Three publications of a series which when completed will become the third edition of "Altitudes in Canada" were printed and are being distributed. This edition has the advantage of the adjusted precise level net of the Geodetic Survey of Canada.

Continued requests for geodetic control data have been received from other federal departments, provincial government departments, municipal corporations, and the engineering and surveying public. On every occasion the most recently determined data were promptly supplied.

Five publications of the Geodetic Survey of Canada were printed and are being distributed by means of special mailing lists, notification cards, and correspondence.

TRIANGULATION DIVISION

Field Work.—During the season of 1933, as in 1931 and 1932, no new nets were started, and only such triangulation was carried on as would complete certain loops and circuits to provide the maximum of adjustment work with the

minimum of field expenditure. The following table shows relevant data concerning the triangulation nets executed by the Geodetic Survey of Canada:—

TABLE SHOWING TRIANGULATION OPERATIONS OF THE GEODETIC SURVEY

Field Operations	Prior to 1933	1933	Total
	Miles	Miles	Miles
Completed first order triangulation, length	7,350	125	7,475
Completed secondary triangulation, length	1,023	60	1,083
Primary reconnaissance; observing not yet started, length	2,300	100	2,400
Secondary reconnaissance; observing not yet started, length	292	.....	292
Primary traverse, length	503	.....	503

Field work was carried on during September and October, 1933, in the Georgian Bay area, lake Huron, on a net which, when completed, will permit making the final adjustment of some 1,200 miles of triangulation nets in northwestern Quebec and northeastern Ontario. The net fixes the geographical position of a large number of lighthouses, church spires, chimneys, and other points close to the shore of the bay and on the eastern end of Manitoulin island.

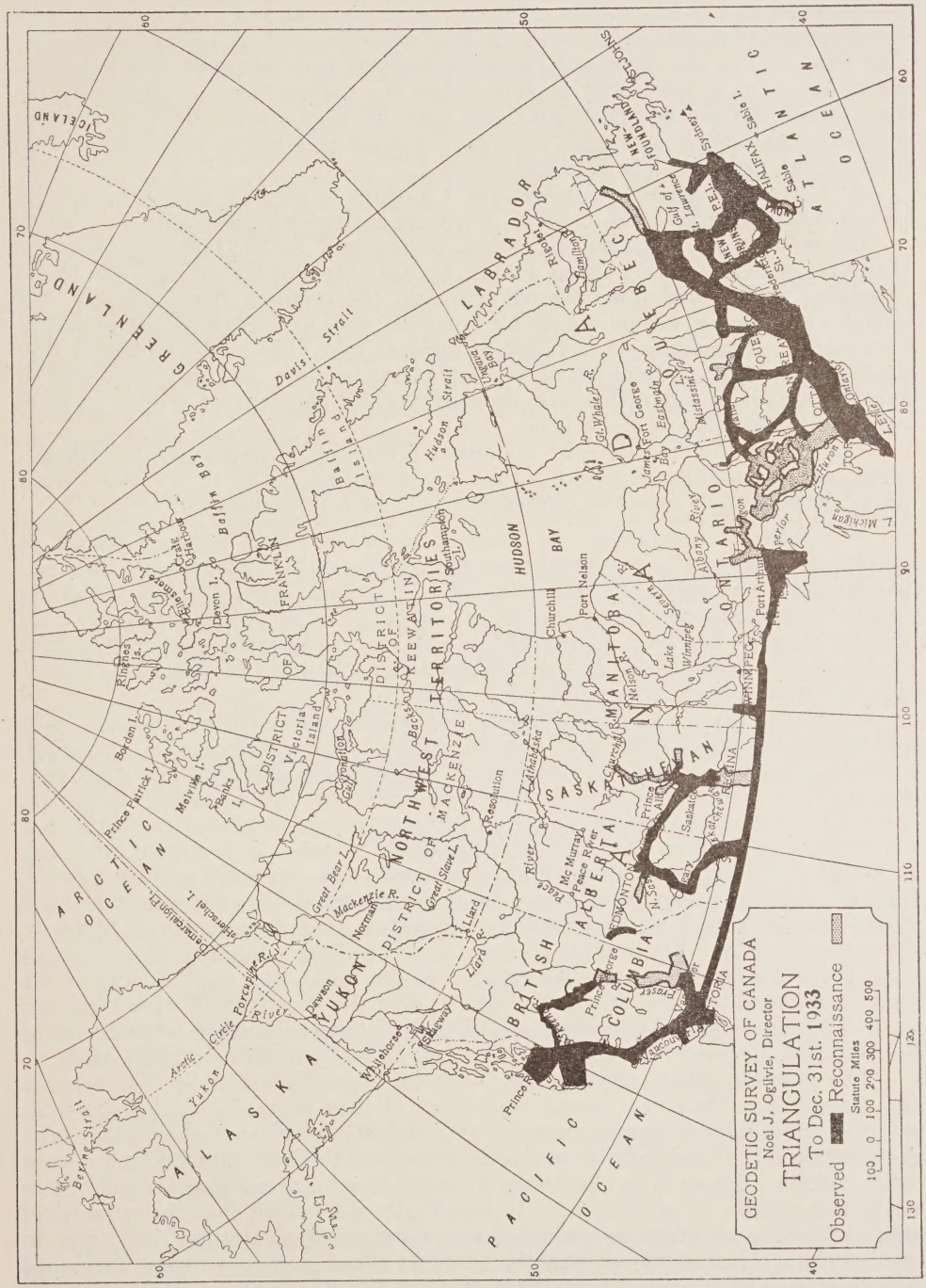
This net, as originally laid out, called for a number of sights to be made across Georgian bay. Although these lines were not excessively long—from 45 to 90 miles—many of them due to the lack of height of the terminal stations, could only be sighted over during periods of abnormal vertical refraction. This abnormal atmospheric condition did not occur sufficiently often, or for long enough periods, to permit the completion of the angle measurements during 1933.

When it became apparent that the work could not be finished in 1933 a reconnaissance was undertaken to determine if an alternative net could be selected which would not require abnormal refraction for making its angular measurements. It was found possible to select a net along the Bruce peninsula, thence to Manitoulin island which, with the completed portions of the former net would be suitable for the purpose. It is expected the preparation and observations of this alternative net will be carried out in the spring of 1934.

Abnormal Vertical Refraction.—As situations occasionally occur in which abnormal arching of the ray of light must be used to sight between stations which are not usually intervisible, it is needful to understand the underlying causes so that the prediction by the Meteorological Service of the times of the occurrence of these abnormal conditions can be applied.

At the close of the 1933 field season these questions were taken up with the Meteorological Service of the Department of Marine, and the following explanation is the result of that conference. The basic feature of vertical refraction in any degree is the decrease of density of the air at levels above the earth's surface, and the decisive factor in abnormal refraction is an unusually rapid decrease of density with height. In other words abnormal refraction will occur when the temperature increases with height rather than decreases, as is usually the case. In an extreme case if the air becomes warmer with height at the rate of about 11 degrees C. per 100 metres at certain pressures and temperatures an observer could see indefinitely long distances. Such a condition would occur either if unusually cold air were drawn in at the ground surface or if unusually warm air moved in at higher altitudes covering a more or less permanent cold surface layer.

In examining the weather maps on occasions in which abnormal seeing was reported in the Georgian Bay region in September and October, 1933, the Meteorological Service of Canada has found definite evidence of warm air being


GEODETIC SURVEY OF CANADA
Noel J. Ogilvie, Director
TRIANGULATION
To Dec. 31st, 1933
Observed
Reconnaissance
Statute Miles
100 0 100 200 300 400 500
GREENLAND
ICELAND
LABRADOR
QUEBEC
ONTARIO
MANITOBA
SASKATCHEWAN
ALBERTA
BRITISH COLUMBIA
YUKON
ALASKA
NORTHWEST TERRITORIES
DISTRICT OF KEEWATIN
DISTRICT OF MACKENZIE
DISTRICT OF FRANKLIN
DISTRICT OF Victoria Island
HUDSON BAY
ARCTIC OCEAN
PACIFIC OCEAN
ATLANTIC OCEAN
NEW FOUNDLAND
NOVA SCOTIA
P.E.I.
NEW BRUNS.
Baffin Bay
Davis Strait
Hudson Strait
Ungava Bay
Hamilton
Rigolet
Gulf of St. Lawrence
Sydney
HALIFAX
Sable I.
ST. JOHNS
Fort George
James Bay
Eastmain
Mistassini
Ot. Whale R.
Albany River
Fort Nelson
Churchill
Southampton I.
Lake Winnipeg
Nelson
Port Arthur
Superior
L. Michigan
L. Huron
L. Erie
Ottawa
TORONTO
WINNIPEG
REGINA
Saskatchewan
Prince Albert
Athabaska
Resolution
Great Slave L.
Great Bear L.
Mackenzie R.
Norman
Liard R.
Liard
Mc Murray
Peace River
River
EDMONTON
N. Sask.
Prince George
Fraser
Vancouver
VICTORIA
Prince R.
Whitehorse
Skagway
Dawson
Yukon River
Arctic Circle
Porcupine R.
Demarcation Pt.
Herschel I.
Melville I.
Banks I.
Victoria Island
Prince Patrick I.
Borden I.
Ringnes Is.
Devon I.
Craig Harbour
Bellesmere I.
Bering Strait

moved in at great heights over colder air. It would naturally be expected that these periods would not continue for a long time as the warm air will move away or warm up the underlying cooler surface air. This explains the experience of September and October, 1933, when the occurrences of abnormal seeing seldom lasted longer than twenty minutes to half an hour, and sometimes much less. This also explains the reports of lighthouse keepers and fishermen that abnormal seeing occurs most frequently in June, when the surface layer is chilled by the water while the air at higher altitudes may be very warm. It also explains why abnormal seeing was more frequently noticed just before northeast or east winds which are generally cold winds.

The Meteorological Service believes it possible to forecast twelve to twenty-four hours in advance when a warm upper air current will develop.

Occurrences of abnormal refraction in the gulf of St. Lawrence and the Maritime Provinces have been found by the Meteorological Service to be associated with a deep low pressure area near the strait of Belle Isle. In this synoptic situation a wedge of cold air from the west or northwest has underrun warmer air. This situation is easier to forecast than that in the Georgian Bay district since the temperature of the advancing surface air may be observed directly, and it is not difficult to forecast the development of a low pressure centre in the locality of Belle Isle.

The forecasting of times of abnormal refraction is important to triangulators, as, if possible, it would permit an observing party to do other work during periods when excessive refraction would be most unlikely.

Theodolite Investigation.—As touched on in the report of the Director of the Geodetic Survey for the fiscal year ending March 31, 1933, a very thorough investigation was made in 1932 and 1933 of a light type, $5\frac{1}{2}$-inch theodolite designed for the precise measurement of angles. Ten of these theodolites have been used by the Geodetic Survey of Canada, and considerable economy in field work has been possible due to their light weight and speed of operation, especially in country where transportation is difficult.

Mingled with an extensive number of satisfactory results produced with this type of theodolite there were puzzling errors. These were of the type which could be, and are, caused by atmospheric disturbances, but they occurred considerably more frequently than is usual with errors due to this cause. In certain cases the values of angles measured on consecutive nights agreed perfectly, but when the same observer with the same theodolite returned to a station later, one or more of the angles differed by large amounts, once as large as five seconds, from the original values; in one case an angle measured from the top of a tower varied considerably from that measured from the ground on the same night by the same observer. While these occurrences, as well as a number of instrument tests, pointed strongly to troubles external to the theodolite, some doubts of the instrument persisted, and it was decided to give the theodolite a very thorough test. The investigation was conducted largely in the collimator laboratories of the National Research Council, in co-operation with an officer of that staff.

The possible errors were so small—never more than two to four seconds and usually less than one second—and even if they were due to instrumental troubles, their nature was so unusual and deeply hidden that their cause and the working out of methods of testing to determine their amount became a very difficult work. Many false clues were followed which proved abortive only after weeks and months of experiment. It was finally discovered that the cylindrical axes—alidade and telescope—which have very small clearances, had, due to secular change in the metal, slightly changed shape and had hence developed minute strains which were transmitted through the standards and telescope and produced minute deflections of the collimation axis. These strains and deflections varied as the telescope was swung in azimuth or tilted in altitude and produced variable angular errors when the telescope was sighted on various objects.

It was found that a large proportion of the cylindrical axis theodolites of this very desirable type were subject to the above class of errors. By the application of the principles of kinematical design, so far as they could be applied without major changes of design, it was possible to eliminate a large part of the troubles which had been discovered and so to render these theodolites capable of the highest precision as angle measuring instruments.

The investigation, in addition to its primary object of testing and improving triangulation theodolites, had two other important results. The first was the development of a method of testing geodetic theodolites out of doors, which makes it possible for the engineer to thoroughly test his theodolite even when laboratory equipment is not available. The second of these results has established the fact that some observers make very different pointings on dim and on bright lights and on other objects which have different aspects. This may amount to as much as two to three seconds of arc in an angle, a large error in triangulation of the highest order, and while eccentricities of this order of magnitude are uncommon it was found that they tended to be present to a minor degree with almost all observers. The addition of a simple reversing prism on the eyepiece end of the telescope, by which the image is reversed horizontally during half of a series of observations has eliminated this personal error of observation and removed a source of error which, though generally small, may under certain conditions be appreciable.

Several precautions and an observational procedure have been suggested by this investigation which, even with present theodolites of this type, will minimize the errors found.

Three papers by members of the staff of the Geodetic Survey, Department of the Interior, which cover the subject fully, have been published in the March, 1934, issue of the Canadian Journal of Research under the titles: (1) "Variable Personal Equation of Bisection in Primary Triangulation, by J. L. Rannie and W. M. Dennis." (2) "Improving the Performance of Primary Triangulation Theodolites as a Result of Laboratory Tests, by J. L. Rannie and W. M. Dennis." (3) "A Field Test of Primary Triangulation Theodolites, by J. L. Rannie." A limited number of reprints of these papers are in the hands of the Director of the Geodetic Survey, and copies may be obtained from him.

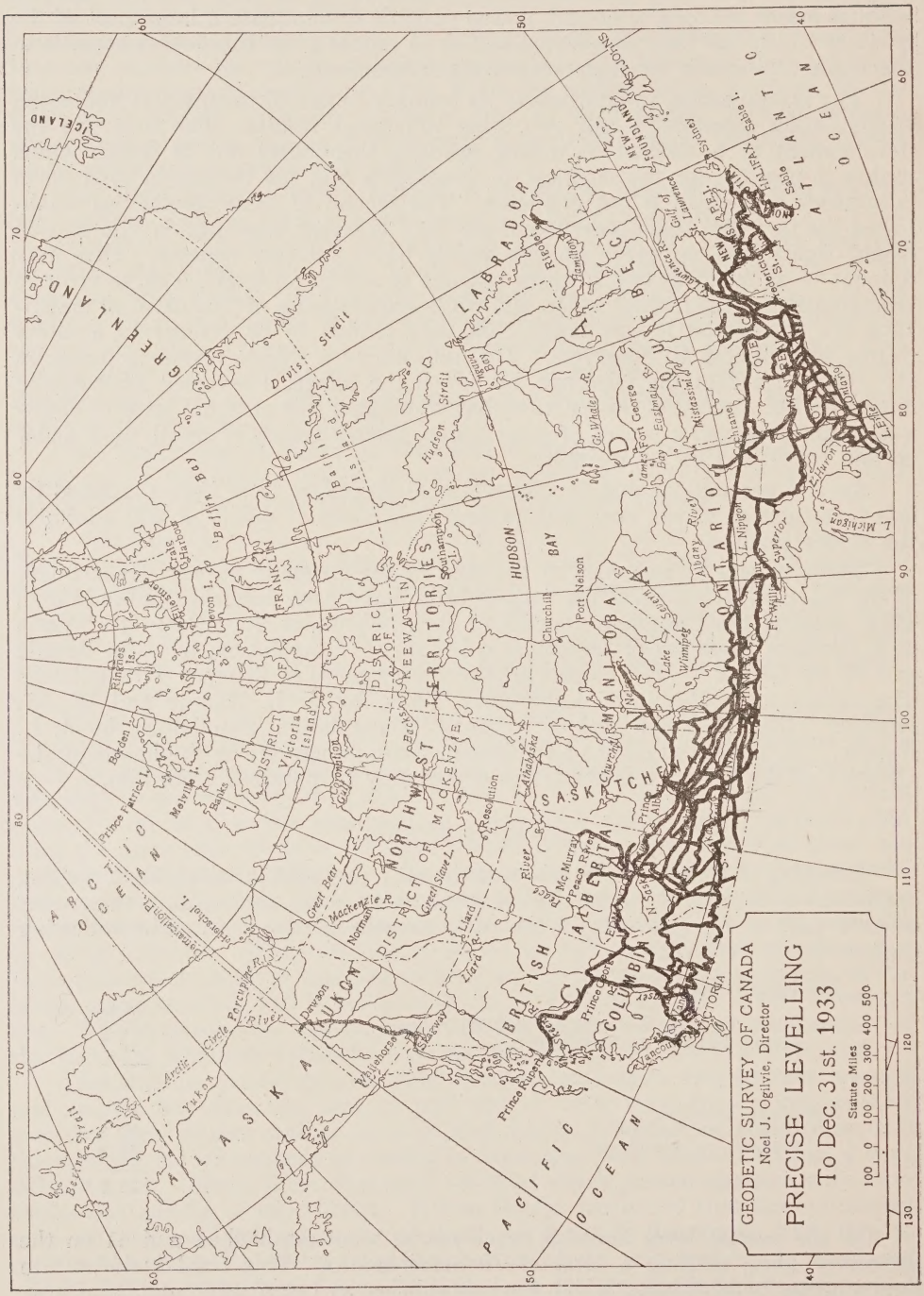
LEVELLING DIVISION

Levelling in Ontario.—Ontario was the only province in which any levelling operations were carried out in 1933, a small party being employed in the south-western part of the province in the early months of the year. The following lines of levels were run:—

	Miles
Precise Levelling—	
Stony Point to Leamington and Windsor	58.3
Mount Brydges to Strathroy	10.7
Total	69.0
Secondary Levelling—	
Dresden to Sarnia	39.3
Petrolia to Strathroy	30.9
Total	70.2

On the precise level lines 38 bench-marks were established and 41 on the secondary lines, making a total of 79 bench-marks. This total includes two Fundamental bench-marks, which were established at Leamington and Strathroy.

All the above levelling was carried out along provincial highways or country roads.


GEODETIC SURVEY OF CANADA
Noel J. Ogilvie, Director
PRECISE LEVELLING
To Dec. 31st, 1933
Statute Miles
100 0 100 200 300 400 500
GREENLAND
ICELAND
Davis Strait
Baffin Bay
LABRADOR
NEWFOUNDLAND
QUEBEC
ONTARIO
MANITOBA
SASKATCHEWAN
ALBERTA
BRITISH COLUMBIA
YUKON
ALASKA
HUDSON BAY
FRANKLIN
DISTRICT OF MACKENZIE
NORTHWEST TERRITORIES
ATLANTIC OCEAN
PACIFIC OCEAN
ARCTIC OCEAN
Hudson Strait
Ellesmere I.
Devon I.
Victoria Island
Banks I.
Melville I.
Prince Patrick I.
Borden I.
Mackenzie R.
Great Bear L.
Great Slave L.
Peace River
Athabaska
Churchill R.
Nelson R.
Port Nelson
Churchill
Southampton I.
Whale R.
Fort George
Eastmain
Rupert R.
Albany River
Lake Superior
L. Nipigon
Ft. William
Toronto
L. Michigan
Lake Winnipeg
Saskatchewan R.
Prince Albert
Edmonton
Calgary
Lethbridge
Fort Macleod
Prince George
Vancouver
Victoria
Prince Rupert
Fraser R.
Yukon R.
Dawson
Whitehorse
Mayo
Arctic Circle
Beaufort Sea
Bering Strait
Mackenzie R.
Liard R.
Peace R.
Hamilton
Quebec
Montreal
St. Lawrence R.
Saguenay R.
Anticosti I.
Sable I.
Gaspe
Restigouche
Miramichi
St. John
Halifax
Yarmouth
Labrador
Ungava Bay
Hudson Strait
Baffin I.
Ellesmere I.
Devon I.
Victoria Island
Banks I.
Melville I.
Prince Patrick I.
Borden I.
Mackenzie R.
Great Bear L.
Great Slave L.
Peace River
Athabaska
Churchill R.
Nelson R.
Port Nelson
Churchill
Southampton I.
Whale R.
Fort George
Eastmain
Rupert R.
Albany River
Lake Superior
L. Nipigon
Ft. William
Toronto
L. Michigan
Lake Winnipeg
Saskatchewan R.
Prince Albert
Edmonton
Calgary
Lethbridge
Fort Macleod
Prince George
Vancouver
Victoria
Prince Rupert
Fraser R.
Yukon R.
Dawson
Whitehorse
Mayo
Arctic Circle
Beaufort Sea
Bering Strait
Mackenzie R.
Liard R.
Peace R.
Hamilton
Quebec
Montreal
St. Lawrence R.
Saguenay R.
Anticosti I.
Sable I.
Gaspe
Restigouche
Miramichi
St. John
Halifax
Yarmouth
Labrador
Ungava Bay
Hudson Strait
Baffin I.

Inspection of Bench-marks.—The work of inspecting and redescribing bench-marks taken over from the levelling system of the Department of Public Works was continued during 1933. Lines on both sides of the St. Lawrence river between Montreal and Quebec were covered, also along the Richelieu river between Sorel and St. Johns and certain lines in the Beauharnois district. In all about 700 Public Works bench-marks were visited.

SUMMARY

	Miles	Bench-marks
Precise Levelling—		
Prior to 1933	24,621	8,632
1933	69	38
Total	24,690	8,670
Secondary Levelling—		
Prior to 1933	11,275	3,891
1933	70	41
Total	11,345	3,932

The total mileage of levelling at the end of the year 1933 was as follows:—

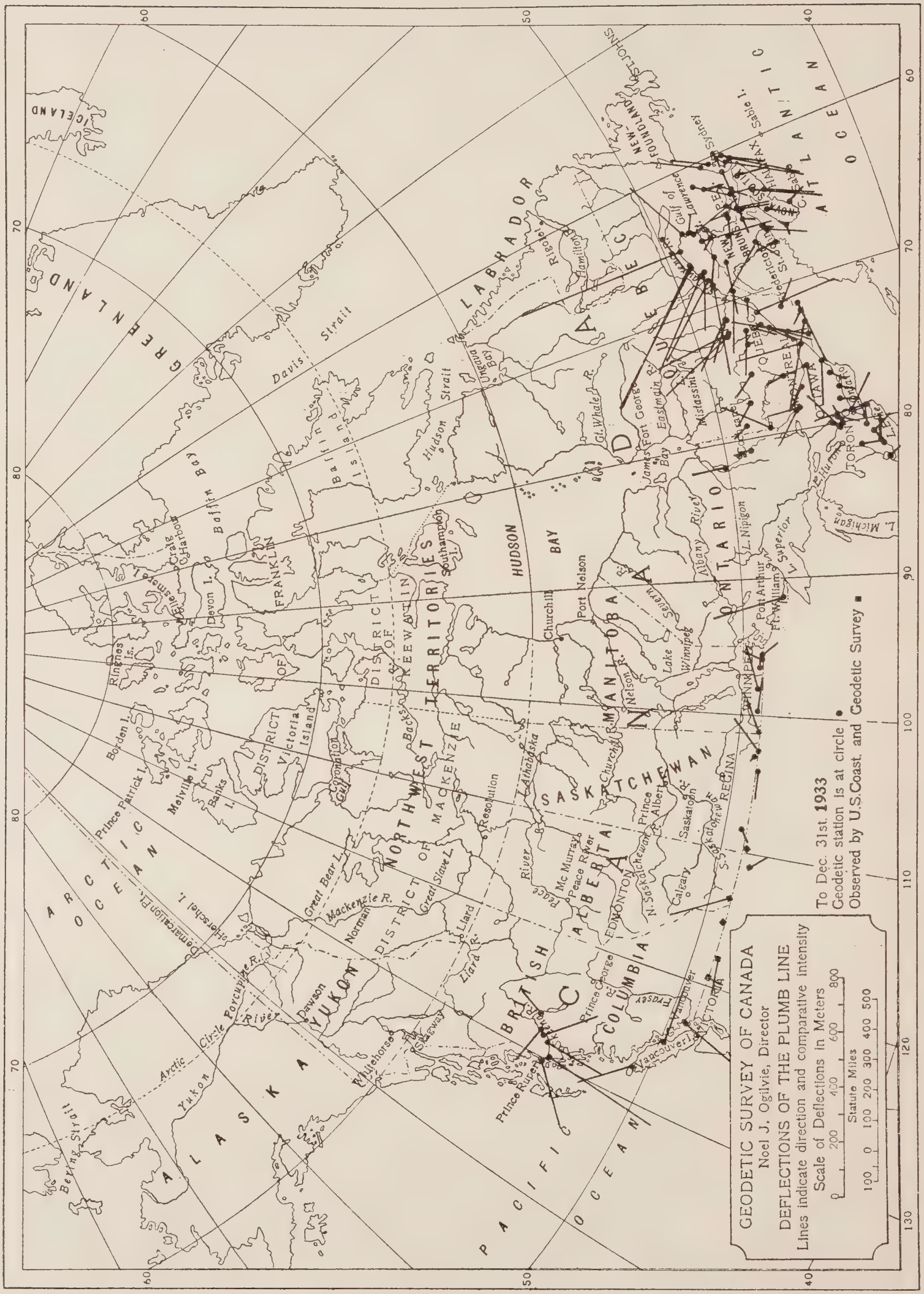
	Precise	Secondary
Nova Scotia	729	0
New Brunswick	1,096	0
Quebec	3,418	640
Ontario	5,997	1,324
Manitoba	2,263	368
Saskatchewan	4,113	5,098
British Columbia	2,866	3,795
Alberta	3,655	120
Yukon	458	0
Minnesota (U.S.A.	89	0
Vermont (U.S.A.)	6	0
	24,690	11,345

Publications.—During the year three more publications of the series constituting the third edition of "Altitudes in Canada" were printed and distributed. Publication No. 39, "Altitudes in Nova Scotia and Prince Edward Island," contains 83 pages and is a compendium of some 4,000 altitudes. Publication No. 40, "Altitudes in New Brunswick," contains 84 pages and gives 4,000 altitudes in that province. Publication No. 48, "Altitudes in Saskatchewan North of Latitude 51° 30′," contains 80 pages and gives 8,000 altitudes in the northern portion of that province.

DIVISION OF GEODETIC ASTRONOMY AND ISOSTASY

Geodetic Astronomy.—During the year 1933-34 the field work of the division of Geodetic Astronomy and Isostasy was confined almost entirely to the observations made in connection with the International World-Longitude campaign conducted under the auspices of the International Union of Geodesy and Geophysics. Three engineers of the Geodetic Survey of Canada made observations for time, at the Geodetic Survey observatory, every night from September 15 to December 3, 1933, when weather conditions permitted. The observers worked in rotation two on each night, one before and the other after midnight. In all, seventy time-determinations were obtained. Wireless time signals from the broadcasting stations at Rugby, England; Bordeaux, France; Nauen, Germany; and Annapolis, U.S.A., were observed several times a day; in all more than five hundred sets of wireless time signals were taken, each set of signals giving a longitude determination.

It will be of interest to note that the three observers used the same astronomical transit, one of the broken telescope type. In the final result of the work as published later, while the absolute personal equation may not be entirely


GEODETIC SURVEY OF CANADA
Noel J. Ogilvie, Director
DEFLECTIONS OF THE PLUMB LINE
Lines indicate direction and comparative intensity
Scale of Deflections in Meters
0 200 400 600 800
Statute Miles
100 0 100 200 300 400 500
To Dec. 31st. 1933
Geodetic station is at circle
Observed by U.S.Coast. and Geodetic Survey
ARCTIC OCEAN
PACIFIC OCEAN
ATLANTIC OCEAN
GREENLAND
ICELAND
ALASKA
YUKON
BRITISH COLUMBIA
ALBERTA
SASKATCHEWAN
MANITOBA
ONTARIO
QUEBEC
LABRADOR
NEWFOUNDLAND
NORTHWEST TERRITORIES
DISTRICT OF MACKENZIE
DISTRICT OF KEEWATIN
DISTRICT OF FRANKLIN
HUDSON BAY
Davis Strait
Baffin Bay
Hudson Strait
James Bay
Gulf of St. Lawrence
Bering Strait
Dawson
Whitehorse
Prince Rupert
Vancouver
Victoria
Edmonton
Calgary
Regina
Winnipeg
Churchill
Port Nelson
Port Arthur
Ft. William
Toronto
Ottawa
Montreal
Quebec
Halifax
Sydney
Sable I.
L. Superior
L. Michigan
L. Huron
L. Erie
L. Nipigon
Lake Winnipeg
Great Bear L.
Great Slave L.
L. Athabaska
Victoria Island
Banks I.
Melville I.
Prince Patrick I.
Borden I.
Ellesmere I.
Devon I.
Southampton I.
Herschel I.

eliminated, yet the combination of the results from the three observers will give a determination in which the personal error is very small indeed.

Isostasy.—The curtailment of the regular field work has made impossible the securing of further data for the investigation on isostasy. There is no field of geodetic research where the expenditure of a small amount of money will give larger returns than here. It is the hope that this phase of geodetic investigation, which at the present time is engaging the attention of geodesists everywhere, and for which Canada, on account of her large areas and varied topography offers a splendid field of operations, will be given the attention it deserves.

DIVISION OF GEODETIC RESEARCH

During the past year, further study of the problem of transferring triangulation results from the Clarke spheroid to the International ellipsoid has been made by this division. The International ellipsoid has been recommended for universal adoption by the International Geodetic and Geophysical Union. It is evident that a satisfactory solution of the problem will be of widespread value since the geodetic results of other countries are not, at the present time, based on this ellipsoid. Also, a revision of certain portions of the manuscript dealing with long geodetic lines has been made.

DIVISION OF TRIANGULATION ADJUSTMENTS

The work of this division during the last year has been confined largely to a continuation of the publication program outlined in previous reports. The report for the area bordering the St. Lawrence River Valley from about 30 miles east of Montreal, westerly to about 25 miles west of Belleville, Ontario, with an extension northerly from Ottawa some 60 miles up the Gatineau Valley, has been published and distributed.

The above program now makes available in printed form the results of the triangulation of the Geodetic Survey of Canada for a continuous area immediately adjacent to the international boundary, from near Windsor, Ontario, easterly to Cape Breton, Nova Scotia, and southwestern Newfoundland. This triangulation has been broken up into convenient units for adjustment, resulting in the following list of publications with the respective areas covered:—

No. 29. "Triangulation in Southwestern Ontario." Area: Westerly from Belleville to Lake Huron and northerly from Lake Erie to Georgian Bay.

No. 30. "Triangulation in New Brunswick and Nova Scotia." Area: From the western end of the Bay of Fundy easterly to Amherst and Truro, N.S., thence southerly to Halifax, thence southwesterly to Liverpool and northerly to Caledonia, N.S.

No. 31. "Triangulation in Quebec and New Brunswick." Area: Chaleur Bay from the eastern extremity of the Gaspé Peninsula to slightly west of Campbellton, N.B., thence northerly to the St. Lawrence River near Mont Joli, Quebec.

No. 32. "Triangulation in New Brunswick and Prince Edward Island." Area: The eastern and western limits of New Brunswick, Northumberland Strait, the western and Charlottetown areas in Prince Edward Island.

No. 33. "Triangulation in Eastern Nova Scotia, Magdalen Islands, and Southwestern Newfoundland." Area: Nova Scotia easterly from Truro to Sydney, thence northerly to Money Point, with extensions to the Magdalen Islands and southwestern Newfoundland.

No. 34. "Triangulation in Quebec." Area: Easterly from Montreal along the St. Lawrence River Valley to Anticosti Island and the eastern extremity of the Gaspé Peninsula.

No. 35. "Triangulation Closure in the Maritime Provinces: Latitude and Longitude Nomograms." A statement of the methods employed in the adjustment of the main framework, also the construction of latitude and longitude nomograms used in the revision of geographic positions.

No. 55. "Triangulation in Southeastern Ontario and the Montreal Area." Area: Montreal westerly to Belleville along the St. Lawrence Valley, northerly to the Ottawa Valley, with an extension up the Gatineau Valley. Also an intensive triangulation survey of Montreal City area and vicinity within a radius of forty miles.

The study of the geoid form, as derived from astronomic-geodetic comparison of values at coincident stations, has had to be discontinued because of lack of further data. The general study has been continued, however, and a geoid form determined for the area east of the 98th meridian of longitude, based only on topography and compensation. The highest point, twelve feet, lies in central Labrador. These studies are essential to form opinions of the continued suitability of the values assigned for latitude, longitude, and azimuth at the origin of survey.

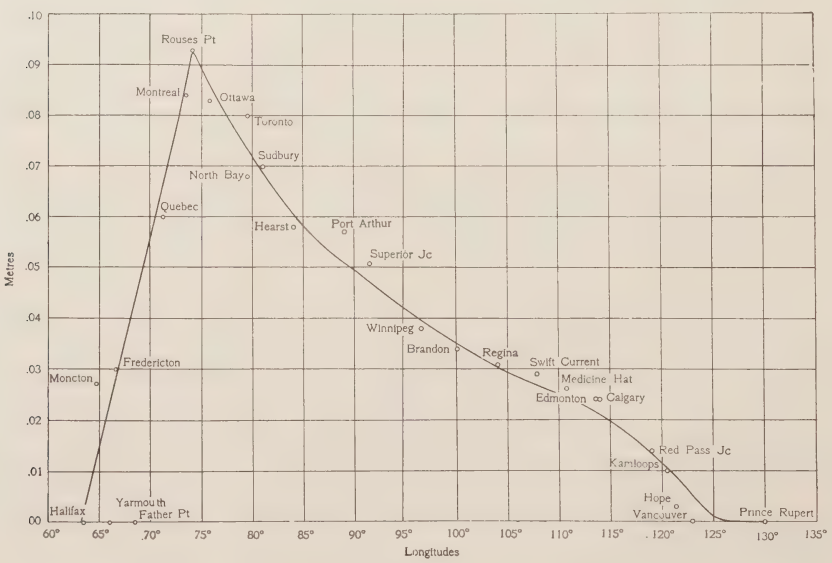
Various requests for geographic positions from other Government bureaus, engineering corporations, and private individuals have been received and the information compiled and forwarded. These requests are constantly growing in number and reflect an increasing use of geodetic work as control in other survey operations.

DIVISION OF LEVELLING ADJUSTMENTS

During the year 1933-34, another adjustment of the Precise Level Net of Canada was carried out involving a new circuit in the neighbourhood of Chatham, Ontario. This was necessitated by a new circuit formed by a level line running from Glencoe south to lake Erie and along the highway to a point south of Chatham, thence north to that city. The corrections, of course, were confined to the immediate locality.

Tables were prepared showing comparative elevations resulting from various adjustments—(1) 1928 Adjustment—Rouses Point held; (2) Squamish held; (3) neither held; and (4) the new circuit mentioned above added.

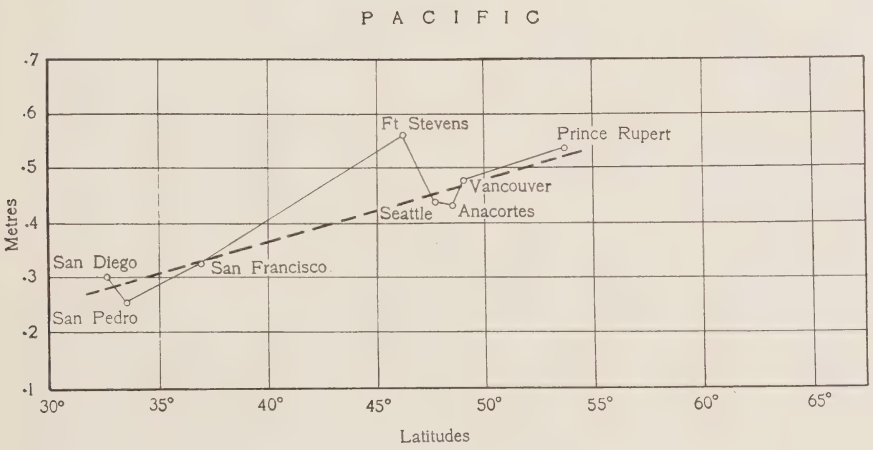
1928 - "A"



There was also in course of preparation a publication entitled "Recent Adjustments of the Precise Level Net of Canada," which has been delayed to allow for further work on the sea-level problem. This is still under consideration, and an attempt is being made to show the relation between sea-level tidal stations along the Atlantic coast and resulting adjusted elevations from Canada and United States adjustments.

PUBLICATIONS OF THE GEODETIC SURVEY OF CANADA

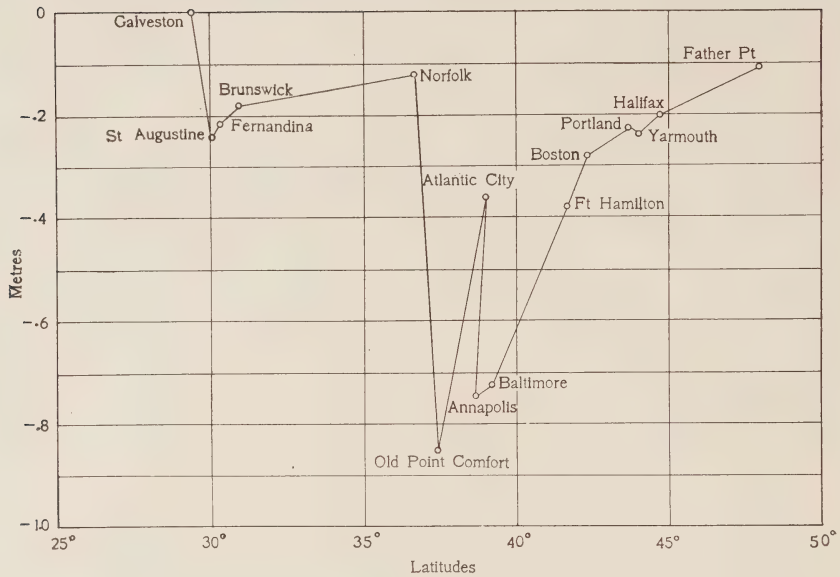
The publications of the Geodetic Survey of Canada printed during the year 1933-34 are: No. 39—"Altitudes in Nova Scotia and Prince Edward Island"; No. 40—"Altitudes in New Brunswick"; No. 48—"Altitudes in Saskatchewan, North of Latitude 51° 30′"; No. 55—"Triangulation in Southeastern Ontario"; and the Annual Report of the Director of the Geodetic Survey of Canada for the Fiscal Year ended March 31, 1933. Magazine articles and radio broadcasts on the Geodetic Survey were also prepared. Notification cards, specially selected mailing lists, and correspondence were used in the distribution of these publications.



RELATIVE HEIGHTS OF SEA LEVEL

Special Adjustment 1929 Based on Galveston

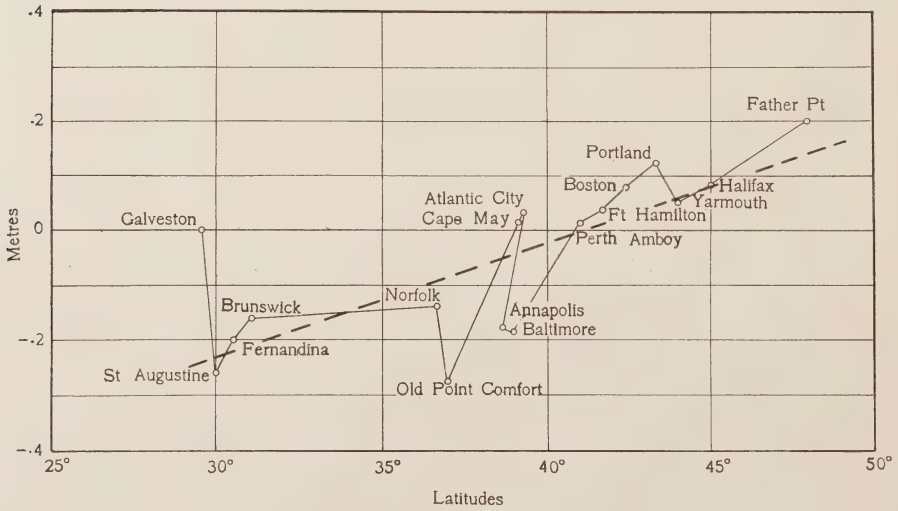
A T L A N T I C



R E L A T I V E H E I G H T S O F S E A L E V E L

Observed from Point to Point, Starting at Galveston

A T L A N T I C



PUBLICATIONS OF THE GEODETIC SURVEY OF CANADA

Publication No.

3—Determination of Lengths of Invar Base Line Tapes from Standard Nickel Bar No. 10239.

5—Field Instructions to Geodetic Engineers in Charge of Direction Measurement on Primary Triangulation.

8—Field Instructions for Precise Levelling.

11—Geodesy.

12—Statistics of the Geodetic Survey of London, Ont. (Distributed at London.)

14—Levelling, Co-ordination of Elevations of Bench Marks in Calgary, Alberta.

15—Bench Marks along Meridians, Base Lines and Township Outlines in Saskatchewan.

16—Levelling. Precise Levelling in Nova Scotia, New Brunswick and Prince Edward Island.

17—Levelling. Precise Levelling in Quebec South of St. Lawrence River.

18—Levelling. Precise Levelling in Quebec North of St. Lawrence River.

19—Levelling. Precise Levelling in Ontario South of Parry Sound.

20—Levelling. Precise Levelling in Ontario North of Parry Sound.

21—Levelling. Precise Levelling in Manitoba.

22—Levelling. Precise Levelling in Saskatchewan.

23—Levelling. Precise Levelling in Alberta.

24—Levelling. Precise Levelling in British Columbia.

25—The Conversion of Latitudes and Departures of a Traverse to Geodetic Differences of Latitude and Longitude.

26—The Simultaneous Adjustment of Precise Traverses and Triangulation Nets.

27—The Differential Adjustment of Observations.

28—Adjustment of Precise Level Net of Canada, 1928.

29—Triangulation in Southwestern Ontario.

30—Triangulation in New Brunswick and Nova Scotia.

31—Triangulation in Quebec and New Brunswick.

32—Triangulation in New Brunswick and Prince Edward Island.

33—Triangulation in Eastern Nova Scotia, Magdalen Islands.

34—Triangulation in Quebec.

35—Triangulation Closure in the Maritime Provinces.

36—Deflection of the Plumb Line in Canada.
Operations of the Geodetic Survey of Canada, April, 1912, to March, 1922. First General Assembly of the International Geodetic and Geophysical Union, Rome, 1922.
Operations of the Geodetic Survey of Canada, April, 1922, to March, 1924. Second General Assembly of the International Geodetic and Geophysical Union, Madrid, 1924.
Operations of the Geodetic Survey of Canada, April, 1924, to December, 1926. Third General Assembly of the International Geodetic and Geophysical Union, Prague, 1927.

37—Geodetic Operations in Canada—January 1, 1927, to December 31, 1929. Reports of the Section of Geodesy—The International Geodetic and Geophysical Union, Fourth General Conference, Stockholm, 1930.

38—Precise Levelling on Vancouver Island.

39—Altitudes in Nova Scotia and Prince Edward Island.

40—Altitudes in New Brunswick.

47—Altitudes in Saskatchewan South of Latitude 50° 31′.

48—Altitudes in Saskatchewan North of Latitude 51° 30′.

53—Geodetic Operations in Canada—January 1, 1930, to December 31, 1932. Reports of the International Association of Geodesy. The International Geodetic and Geophysical Union, Fifth General Conference, Lisbon, 1933.

54—The Direct and Inverse Solution of Long Geodetic Lines.

55—Triangulation in Southeastern Ontario.
Annual Report of the Superintendent of the Geodetic Survey of Canada for the fiscal year ending March 31, 1918. The same for the year 1922.
Annual Reports of the Director of the Geodetic Survey of Canada for the fiscal years 1923, 1924, 1925, 1926, 1927, 1928, 1929, 1930, 1931, 1932, 1933, 1934.
Where name and number (or year) are omitted, the publication is not available for distribution.

Copies of the above publications may be obtained by applying to the Director of the Geodetic Survey of Canada, Department of the Interior, Ottawa.